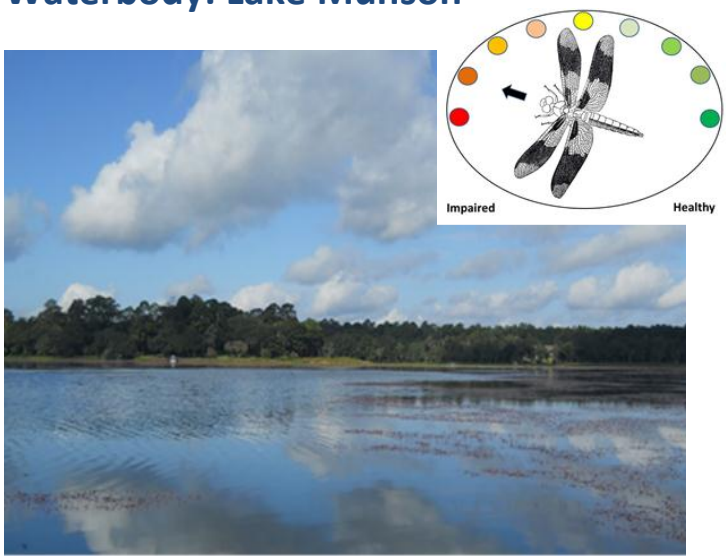
Waterbody: Lake Munson

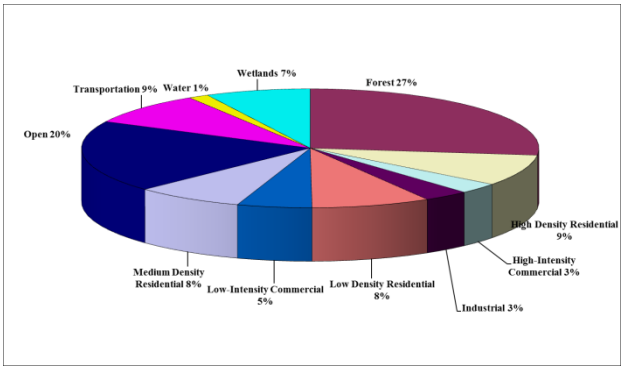


Basin: Lake Munson

Lake Munson is an approximately 255 acre, cypress-rimmed, nitrogen-limited lake located south of the City of Tallahassee. The lake is believed to have originally been a cypress swamp but has since been impounded and now functions as a shallow man-made lake. Lake Munson receives the majority of its water from the heavily altered Munson Slough and its tributaries. Lake outflow continues southward via Munson Slough and finally drains into Ames Sink. Dye trace studies have confirmed a direct connection between Ames Sink and Wakulla Springs.

The lake has a history of severe water quality and ecological problems including fish kills, algal blooms, exotic vegetation and snails, high nutrient and bacterial levels, low game fish productivity, sediment contamination, and depressed oxygen levels.

As shown in the following pie chart, approximately 45% of land use in the 42,526 acre Munson basin is industrial, commercial, residential, or transportation. Increases in stormwater runoff, and waterbody nutrient loads can often be attributed to these types of land uses.



Background

Healthy, well-balanced lake communities may be maintained with some level of human activity, but excessive human disturbance may result in waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (*e.g.,* recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

The lake received a Total Maximum Daily Load (TMDL) by the Florida Department of Environmental Protection (FDEP) in 2013. The TMDL requires the lake to meet the dissolved oxygen criterion and the nutrient TMDL concentrations, which, based on the mean concentrations from the 2004-2008 period, will require a 50 percent reduction for Biological Oxygen Demand (BOD), a 32.5 percent reduction for total nitrogen, a 76.7 percent reduction for total phosphorus and a 31.9 percent reduction in turbidity.

There has been a general consensus that the organic and nutrient-rich sediments in Lake Munson are contributing to the poor water quality and that sediment removal would be the best way to improve the lake's water quality. Unfortunately, sediment removal would be logistically very difficult and extremely expensive. Another option is to

periodically drain the lake. The lake drawdowns are expected to result in de-watering, compaction, and partial oxidation of sediments that produced a sediment "cap" that would serve to improve water quality and simultaneously generate suitable habitat for fish spawning.

On April 27, 2010, the Leon County Board of County Commissioners directed staff to implement the County's Science Advisory Committee lake drawdown recommendations. After additional meetings, which included staff and committee members from the Florida Fish and Wildlife Conservation Commission, FDEP, U.S. Forest Service, Leon County Science Advisory and Water Resource Committees, and the community surrounding the lake, it was decided to start the lake drawdown October 18, 2010. The drawdown continued until June 14, 2011. Sampling recommenced in the third quarter of 2011. Unfortunately, it does not appear that the initial drawdown improved water quality.

Methods

Surface water sampling, sediment sampling and a Lake Vegetation Index (LVI) were conducted and met the collection and analysis requirements of the Florida Department of Environmental Protection (FDEP).

Results

Nutrients

The nutrient thresholds and results are found in Table 1. According to FDEP requirements, Numeric Nutrient Criteria (expressed as an annual geometric mean) cannot be exceeded more than once in a three year period.

Table 1. FDEP's chlorophyll *a*, total nitrogen and phosphorus criteria for lakes applied to Lake Munson. Due to the lake drawdown, staff could not collect samples for the first and second quarters of 2011. Results in bold signify exceedances of the State criteria.

Clear Lakes High Alkalinity	Chl-*a* (20 µg/L)	TN (1.05-1.91 mg/L)	TP (0.03-0.09 mg/L)
2004	3.6	0.35	0.06
2005	13.8	0.62	**0.11**
2006	12.4	1.38	**0.19**
2007	10.9	1.49	**0.30**
2008	13.1	0.76	**0.20**
2009	5.5	0.88	**0.17**
2010	8.7	1.07	**0.16**
2011	-	-	**-**
2012	**39.0**	**1.08**	**0.18**
2013	**85.0**	**1.51**	**0.24**

The geometric mean of chlorophyll *a* is below the 20 µg/L threshold from 2004-2010, allowing the use of lake specific, modified TN and TP criteria. With the exception of 2004, TP levels are higher than the upper value in the specified range, exceeding the state criteria. The geometric mean for chlorophyll *a* in 2013 (85.0 µg/L) was the highest reading on record. Both total nitrogen and total phosphorus exceeded the FDEP's minimum numeric nutrient criteria levels for both 2012 and 2013.

While the lake drawdown appeared to consolidate the sediment, there seems to have been little to no effect regarding nutrient reduction in the water column. As shown in Figures 1 through 4, BOD, total nitrogen, total phosphorus and turbidity continue to be consistently above the TMDL limits. Algal blooms, represented by chlorophyll *a* (Figure 5), also

continue to be a problem in Lake Munson. FDEP analysis determined that samples taken from the algal blooms that occured in February and June of 2013 were dominated by *Microcytis* sp., a known toxin producer. FDEP confirmed that microcystin toxin was being released at the time of the algal blooms.

Unionized Ammonia

Algal blooms can also affect unionized ammonia levels. High levels of unionized ammonia are caused by elevated temperature, ammonia and pH. During daylight hours, algae take carbon dioxide from the water for their metabolic processes. This increases water pH values, allowing unionized ammonia levels to reach potentially toxic levels. During the May 2013 sampling event, the unionized ammonia Class III limit (≤ 0.02 mg/L) was exceeded at both station LMU8 (0.14 mg/L) and LMU7 (0.10 mg/L).

Metals

Both Munson Slough and Lake Munson exceeded Class III water quality criteria for lead several times in 2013. Relict anthropogenic sources such as leaded gasoline are most likely to be the cause of these exceedances.

Click here for more information on metal levels in Leon County waterbodies.

Floral Assessment

The Lake Vegetation Index score for Lake Munson was 61, placing the lake's vegetative community in the healthy category.

Sixty nine species were found during the survey. The native species pond cypress (*Taxodium ascendens*) and coastal plain willow (*Salix caroliniana*) were the most dominant species in the lake. Other native shoreline vegetation included; red maple (*Acer rubrum*), buttonbush (*Cephalanthus occidentalis*) and swamp tupelo (*Nyssa sylvatica* var. *biflora*).

Unfortunately, silk tree (*Albizia julibrissin*), camphor tree (*Cinnamomum camphora*), wild taro (*Colocasia esculenta*), Chinese privet (*Ligustrum sinense*), Peruvian primrose willow (*Ludwigia peruviana*), Japanese climbing fern (*Lygodium japonicum*), small leaf spiderwort (*Tradescantia fluminensis*) and Chinese tallow (*Sapium sebiferum*), all listed as Category I Invasive Exotics by the Florida Exotic Pest Control Council were found in the littoral zone of Lake Munson. Tung tree (*Aleurites fordii*), alligator weed (*Alternanthera philoxeroides*), sweet autumn virginsbower (*Clematis terniflora*) and rattlebox (*Sesbania punicea*) are Category II Invasive Exotics found in the lake. Additionally, the exotic giant reed (*Arundo donax*) was also found in lake.

Click here for more information on the Lake Munson LVI.

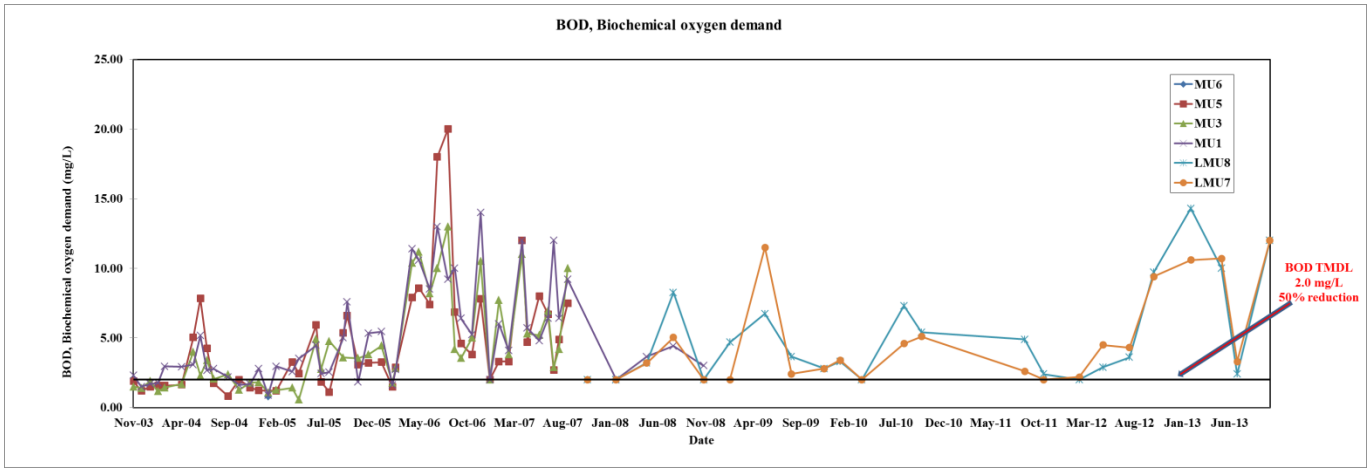


Figure 1. BOD results for Lake Munson.

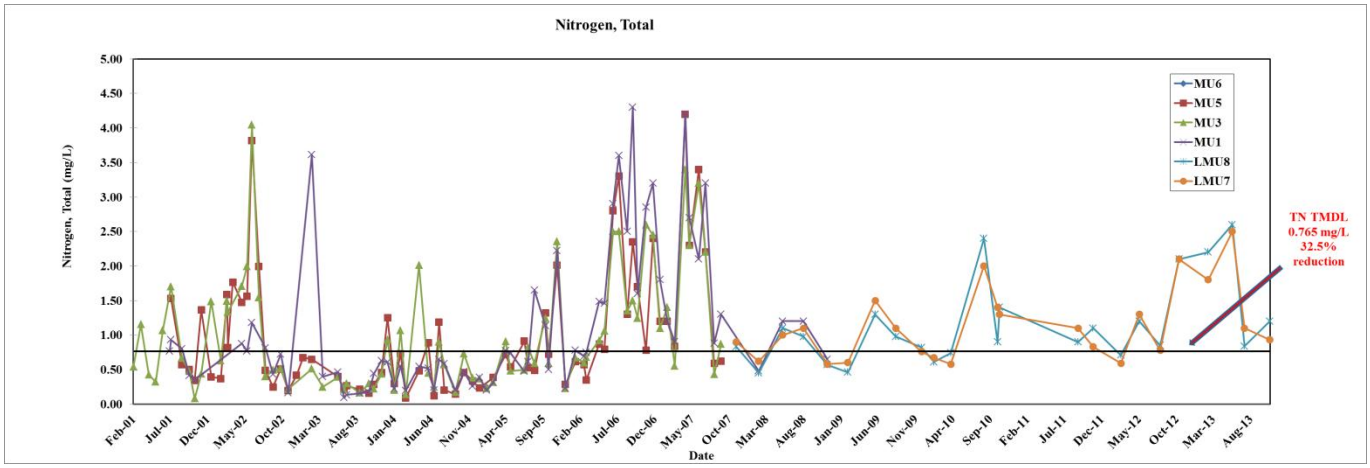


Figure 2. Total Nitrogen results for Lake Munson.

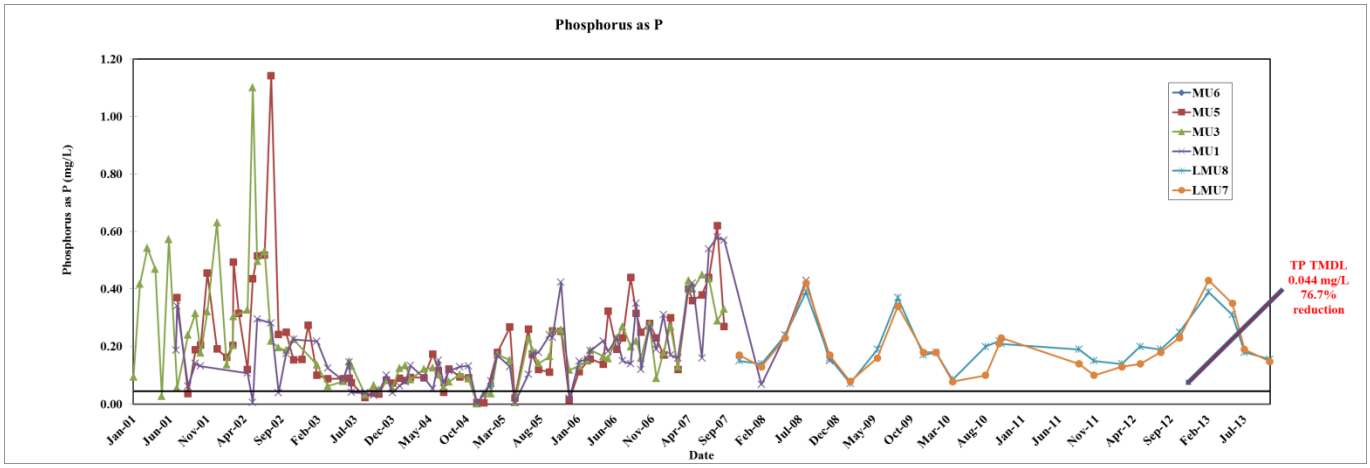


Figure 3. Total phosphorus results for Lake Munson.

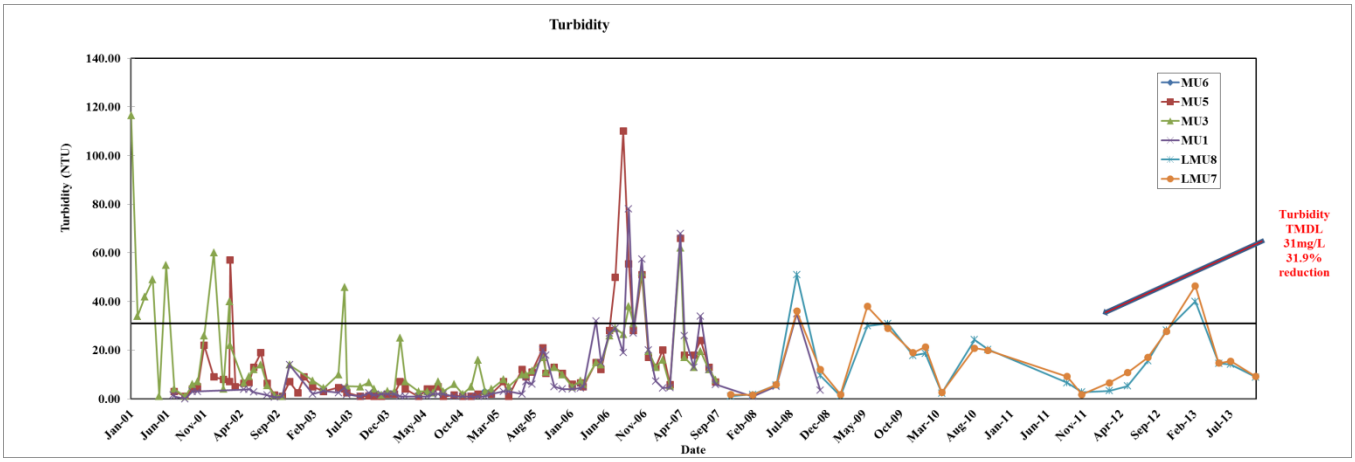


Figure 4. Turbidity results for Lake Munson.

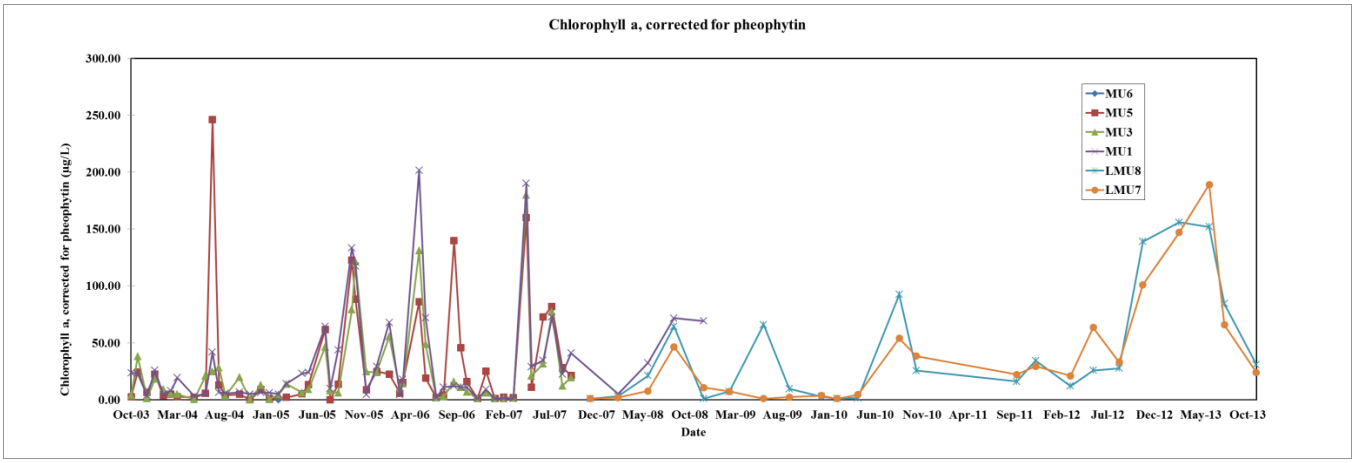


Figure 5. Chlorophyll *a* results for Lake Munson.

Conclusions

Based on ongoing sampling, Lake Munson did not meet the nutrient thresholds for the East Panhandle Region. BOD, total nitrogen, total phosphorus and turbidity continue to be consistently above the TMDL limits. Algal blooms, represented by chlorophyll *a* continue to be a problem in the lake. During the May 2013 sampling event, the unionized ammonia Class III limit (≤ 0.02 mg/L) was exceeded at two/all monitoring stations. The aforementioned statements suggest that the initial lake drawdown seemed to have had little or no effect regarding nutrient reduction in the water column. Lake Munson exceeded Class III water quality criteria for lead several times in 2013. Relict anthropogenic sources such as leaded gasoline are most likely to be the cause of these exceedances. The floral community is considered "healthy" by the LVI.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

Contact and resources for more information

www.LeonCountyFL.gov/WaterResources

Click here to access the results for all water quality stations sampled in 2013.

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